REMARKS

The Office action has been carefully considered. The Office action has rejected claims 1-36 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,230,200 to Forecast et al ("Forecast"). By present amendment, claims 1-36 are cancelled without prejudice. Claims 37-67 have been added as new. Applicant submits that the claims as filed were patentable over the prior art of record, and that the amendments herein are for purposes of clarifying the claims and/or for expediting allowance of the claims and not for reasons related to patentability. Regarding the rejections, applicant respectfully disagrees and traverses these rejections. For the reasons discussed in detail below, all of the pending claims are in condition for allowance. Reconsideration is respectfully requested.

Applicant thanks the Examiner for the interview held (by telephone) on March 24, 2004. During the interview, the Examiner and applicant's attorney discussed the claims with respect to the prior art. The essence of applicant's position is incorporated in the remarks below.

Applicant's technique is generally directed to a system and method for enhancing file system performance by automatically balancing files among randomly-named subdirectories that have content cached therein as files with predictable filenames and by limiting the number of files in any directory. Certain file systems may experience degraded performance when more than a certain number of files are in the same directory. The balancing mechanism of

applicant's invention operates to avoid such degraded performance. To this end, the balancing mechanism tracks the number of files in each directory (or cache directory) and determines whether more directories (or cache directories) need to be created. When one or more additional directories are needed, the balancing mechanism determines how many directories to create and creates that many directories.

Thus when new files are added, the balancing mechanism distributes the files among the various directories based on the directory that has the least number of files. If the number of files in the selected directory plus the number to be stored exceeds a predetermined threshold amount, then directories may be created. If no more directories may be created, then files may be removed from existing directories (such as those which have not been accessed for the longest time).

Note that the above description is for general informational purposes only, and is in no way intended to limit the claims, which are discussed below.

Forecast relates to a technique for allocating component resources for streaming data in a video file server. Forecast describes creating a dynamic model of the configuration of components for data handling in the video file server and allocating the components for routing of a video stream. The model includes assemblies and subassemblies in the video file server. The major sub-assemblies include a stream server, a cached disk array and a tape silo. The cached disk array includes micro-processor cards programmed to function as channel directors or disk directors. Each of the channel directors is interfaced

through one of a number of SCSI adaptors to the SCSI interface of one of the stream servers. The channel directors access data in the cache memory in response to a request from its associated stream server. If data to be read by a channel director are not found in cache memory, the data is transferred from the disk array to the cache memory.

A controller of the file server has programs for automatically creating the dynamic model, modifying the dynamic model in response to component changes such as component failures, allocating component resources for routing of the video stream and balancing allocations of component resources to video streams. The dynamic model is created automatically by collecting information about what components are installed in the file server, the resources of the installed components, and connections between the installed components.

The dynamic model is maintained in memory as a directed acyclic graph in which nodes represent the data handling components and edges represent data stream paths between the data handling components. The program for building the specific hardware configuration collects information about the components actually installed in the file server and determines the resources currently provided by each component. Each node and edge is then provided a list of component resources associated with the node or edge and current allocations of component resources to data streams and other tasks. An allocation program walks through the specific hardware configuration to optimally allocate available resources for handling a request to create a data stream and creates a list indicating a route through the file server for the data stream.

The allocation balancing program described in Forecast may free resources of a heavily loaded cached disk array including a file system containing a video stream for which a copy is stored in the file system in another cached disk array. In this case, the path of the existing stream of data from the heavily loaded cached disk array would be dynamically changed to originate from the copy of the video stream in the other file server in order to free resources of the heavily loaded cached disk array.

Significantly, Forecast does not describe balancing files among directories, as claimed by applicant. Nor does Forecast describe distributing new files that are added among the various directories, as described in applicants' technique. Rather, Forecast describes allocating components in a video file server for streaming video data. In fact, Forecast teaches away from load balancing files. In describing the components of the video file server, Forecast describes two physical file systems: a conventional UNIX File System and a Continuous Media File System (CMFS). The CMFS file system that is used for storing the video data streams may span several disks within a CMFS volume set. When a new CMFS file is created, it is written in a stripe across all the disks within the volume set. Forecast specifically states that "[t]*he reason for multi-disk volume sets is to increase capacity rather than provide load balancing.*" Forecast then further explains that *load balancing for video streams may be accomplished by exporting multiple file systems.* (See Col 11:9-15).

Thus, Forecast teaches away from applicant's invention. Forecast's technique optimizes reading video content and does not load balance files

among directories. He teaches away from applicant's invention by striping across all disks within a volume set to increase capacity and suggests that load balancing of video content may be accomplished by exporting multiple file system.

First, newly added independent claim 37 recites "creating a plurality of randomly-named cache directories, one for each random subdirectory name generated." The section of Forecast allegedly disclosing directories for storing files does not describe creating a plurality of randomly-named cache directories, one for each random subdirectory name generated. Rather, Forecast describes a directed acyclic graph in which nodes represent the data handling components of a video file server and edges represent video data stream paths between the data handling components. Each node of the graph has a list of resources and current allocations of the resources. Forecast does not describe directories as one of the resources listed or as one of the data handling components. Instead, Forecast describes the resources as data handling components such as a stream server, a cached disk array and a tape silo. The cached disk array includes micro-processor cards programmed to function as channel directors or disk directors. Each of the channel directors is interfaced through one of a number of SCSI adaptors to the SCSI interface of one of the stream servers and may prefetch a track in the video stream and store it in the cache of the cached disk array. Nowhere in Forecast is there a description of directories included in the list of resources that are modeled and allocated.

Second, newly added independent claim 37 recites "automatically balancing the files among each of the plurality of randomly-named cache directories." Applicant's technique tracks the number of files in each directory and the balancing mechanism distributes the files among the various directories based on the directory that has the least number of files. The sections of the relied-upon reference allegedly disclosing balancing files among directories do not describe such a balancing technique. Rather, Forecast describes the resources as data handling components such as a stream server, a cached disk array and a tape silo. Forecast further describes allocating these components in a video file server for routing of the video stream. In describing the components of the video file server, Forecast describes two physical file systems: a conventional UNIX File System and a Continuous Media File System (CMFS) in which a file is striped across all the disks within the volume set. Forecast specifically states that "[t]he reason for multi-disk volume sets is to increase capacity rather than provide load balancing," and, thus, Forecast teaches away from applicant's invention.

Forecast further explains that load balancing for video streams may be accomplished by exporting multiple file systems, not balancing files among directories as is done in applicant's technique. (See Col 11:9-15). The allocation balancing program in Forecast may free resources of a heavily loaded cached disk array including a file system containing a video stream. However, to do so, Forecast uses multiple file systems which contain copies of video streams and dynamically changes the path of an existing video stream from the heavily loaded

cached disk array to originate from the copy of the video stream in another file server.

In summary, Forecast's technique optimizes reading video content and does not load balance files among directories. He teaches away from applicant's invention by striping across all disks within a volume set to increase capacity and suggests that load balancing of video content may be accomplished by exporting multiple file systems.

Applicant respectfully submits that dependent claims 38-52, claims 53-66, and claim 67, by similar analysis, are not anticipated by Forecast. Dependent claims 38-52 include the recitation of "automatically balancing the files among each of the plurality of randomly-named cache directories." As discussed above regarding claim 37, the sections of the relied-upon reference allegedly disclosing balancing files among directories do not describe such a balancing technique. Claims 53-66 include the recitation of "a balancing mechanism operably coupled to the name-generation mechanism and operably coupled via an interface to the file system to automatically create a randomly-named cache directory based on a random subdirectory name, the balancing mechanism further configured to distribute files from at least one randomly-named cache directory in the file system to another randomly-named cache directory in the file system." Forecast does not describe such a balancing mechanism. Instead, Forecast teaches away from applicant's technique by striping across all disks within a volume set to increase capacity and suggests that load balancing of video content may be accomplished by exporting multiple file systems. Finally, claim 67 is likewise not

anticipated by Forecast. Claim 36 includes the limitation of "a second data field including data corresponding to a number of files stored in the randomly-named cache directory identified in the first data field, the second data field updated as files are moved among the plurality of randomly-named cache directories." Nowhere in Forecast is there a description of updating a data field as files are moved among a plurality of directories.

CONCLUSION

In view of the foregoing remarks, it is respectfully submitted that claims 37-67 of the present application are patentable over the prior art of record, and that the application is in good and proper form for allowance. A favorable action on the part of the Examiner is earnestly solicited.

If in the opinion of the Examiner a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney at (425) 836-3030.

Respectfully submitted,

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